

ORIGINAL ARTICLE

Shift work and work injury in the New Zealand Blood Donors' Health Study

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Occup Environ Med 2006;**63**:352–358. doi: 10.1136/oem.2005.024398

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Accepted 27 January 2006

Objective: To investigate associations between work patterns and the occurrence of work injury.**Methods:** A cross sectional analysis of the New Zealand Blood Donors Health Study conducted among the 15 687 (70%) participants who reported being in paid employment. After measurement of height and weight, a self-administered questionnaire collected information concerning occupation and work pattern, lifestyle behaviour, sleep, and the occurrence of an injury at work requiring treatment from a doctor during the past 12 months.**Results:** Among paid employees providing information on work pattern, 3119 (21.2%) reported doing shift work (rotating with nights, rotating without nights, or permanent nights) and 1282 (8.7%) sustained a work injury. In unadjusted analysis, work injury was most strongly associated with employment in heavy manual occupations (3.6, 2.8 to 4.6) (relative risk, 95% CI), being male (1.9, 1.7 to 2.2), being obese (1.7, 1.5 to 2.0), working rotating shifts with nights (2.1, 1.7 to 2.5), and working more than three nights a week (1.9, 1.6 to 2.3). Snoring, apnoea or choking during sleep, sleep complaints, and excessive daytime sleepiness were also significantly associated with work injury. When mutually adjusting for all significant risk factors, rotating shift work, with or without nights, remained significantly associated with work injury (1.9, 1.5 to 2.4) and (1.8, 1.2 to 2.6), respectively. Working permanent night shifts was no longer significantly associated with work injury in the adjusted model.**Conclusion:** Work injury is highly associated with rotating shift work, even when accounting for increased exposure to high risk occupations, lifestyle factors, and excessive daytime sleepiness.

Work injury is an important cause of morbidity and mortality.¹ Much of this work injury burden can be found in industries requiring heavy manual work such as trades, plant and machine operations, agriculture, and fishery.² Within occupational groups, previous observational studies have shown that a range of individual and lifestyle factors are associated with increased risk of work injury, including age, obesity, smoking, alcohol or substance abuse, sleep disorders (snoring, apnoea), sleep complaints, and excessive daytime sleepiness.^{3–6} Not surprisingly, shift workers are at particular risk of sleep complaints,^{7–10} a factor possibly contributing to the relatively high rate of fatal and non-fatal work injuries in this group of workers.^{9 11 12} Much of the research published to date, however, has been limited since studies have been largely restricted to specific groups defined by gender, workplace, occupation, or working pattern, have only utilised small study samples or only incorporated a few measures of sleep related variables and lifestyle factors.^{5 8 13} It is still largely unknown whether work injury is primarily attributable to the workplace (occupation, number of working hours, working pattern) or by individual or lifestyle factors.

The New Zealand Blood Donors Health Study (NZBDHS) represents one of the largest projects undertaken to investigate behavioural determinants of serious injury.¹⁴ The aim of the current analysis was to investigate patterns of work, and individual and lifestyle factors associated with work injury among the 15 687 participants of the NZBDHS in paid employment. This information could help more effectively target preventive measures to reduce the rate of occupational injury.

METHODS

Recruitment procedures and methodology of the NZBDHS are detailed elsewhere.¹⁴ In brief, 22 389 blood donors (81%

response rate) were recruited into the study, from April 1998 to October 1999, at blood collection points, managed by the Northern Regional Blood Service, in community halls (20%), business and tertiary education facilities (12%), high schools (20%), rural sites (20%), and metropolitan centres (28%) in the Northland, Auckland, Waikato, and Bay of Plenty regions of New Zealand. Blood donation in New Zealand is a voluntary non-profit service. This catchment area provided a broad cross-section of urban, suburban, and rural areas of New Zealand. The sample size was derived to accommodate investigations of associations between potentially major risk factors such as alcohol use/abuse and fatigue, and injury outcomes such as hospitalisations or death due to road crashes, falls, and work related injury. The study was approved by the regional ethics committees and all participants provided informed consent.

At recruitment, after measurement of height and weight, all NZBDHS participants were asked to complete a self-administered questionnaire. The questionnaire solicited details concerning main occupation, highest education level achieved, ethnicity, marital status, current smoking, usual use of alcohol, marijuana, or illicit drugs in the past 12 months, sleep disorders (reported loud snoring, stopped breathing, or appeared to choke during sleep), sleep dissatisfaction and difficulties, daytime sleepiness as assessed by the Epworth Sleepiness Scale (ESS),¹⁵ and fatigue (Appendix 1). Participants in paid employment were also asked to specify usual work pattern, number of hours usually worked each week, and the number of nights worked in a usual week (Appendix 1). Participants were also asked if they had experienced an injury at work in the past 12 months that had required treatment from a doctor. In New Zealand nearly everyone injured, including overseas visitors and foreign diplomats, is covered for treatment for personal injury caused by accident, regardless of fault.

Table 1 Unadjusted relative risk (RR) of work injury associated with demographic and lifestyle factors among 15 687 paid employees*

		Work injury, n (%)	Total, n	RR (95% CI) work injury
Age (years)	16–24	329 (7.8)	4192	1
	25–39	417 (9.5)	4397	1.23 (1.06–1.43)
	40+	580 (8.6)	6776	1.10 (0.95–1.27)
Gender	Female	502 (6.2)	8059	1
	Male	824 (11.3)	7306	1.91 (1.70–2.15)
BMI (kg/m ²)	15–24	423 (6.9)	6156	1
	25–29	556 (9.2)	6062	1.37 (1.20–1.56)
	30+	334 (11.2)	2987	1.71 (1.47–1.98)
Ethnicity	European/Pakeha	1112 (8.5)	13146	1
	Maori/Pacific Islander/Asian/other	197 (9.6)	2050	1.15 (0.98–1.35)
Marital status	Married or living with partner	761 (8.8)	8643	1
	Never married	453 (8.3)	5427	0.94 (0.84–1.07)
	Other	105 (8.8)	1187	1.01 (0.81–1.24)
Education	Primary/high/secondary	611 (9.5)	6445	1
	Polytechnic or similar	352 (10)	3529	0.99 (0.86–1.14)
	University	243 (6.1)	3962	0.62 (0.54–0.73)
Occupation (Appendix 2)	Legislator/administrator/manager	82 (6.0)	1358	1
	Professional	147 (5.8)	2519	0.96 (0.73–1.27)
	Associate professional/technician	151 (6.7)	2264	1.11 (0.84–1.47)
	Clerk	106 (5.4)	1981	0.88 (0.65–1.18)
	Service/sales	208 (11.5)	1813	2.02 (1.55–2.63)
	Agriculture/trade/machine/elementary	383 (18.7)	2051	3.57 (2.78–4.59)
	Daytime, no shifts	779 (7.9)	9818	1
Usual work pattern	Irregular/other	142 (8.0)	1780	1.06 (0.92–1.24)
	Rotating, no nights	142 (9.5)	1501	1.44 (1.00–2.05)
	Permanent nights	69 (10.8)	638	1.41 (1.08–1.83)
	Rotating, with nights	150 (15.3)	980	2.10 (1.74–2.53)
	None	1042 (8.0)	13034	1
Night work	<3 nights per week	127 (10.4)	1222	1.34 (1.10–1.62)
	≥3 nights per week	157 (14.2)	1109	1.90 (1.59–2.27)
	≤40 per week	715 (7.3)	9849	1
Work hours	>40 per week	576 (11.1)	5166	1.60 (1.43–1.80)
	Low risk	1040 (8.3)	12524	1
Alcohol	High risk	263 (9.9)	2658	1.21 (1.05–1.40)
	No	1047 (8.2)	12831	1
Current smoking	Yes	265 (10.9)	2439	1.37 (1.19–1.58)
	No	1084 (8.3)	13059	1
Marijuana	Yes	233 (10.5)	2228	1.29 (1.11–1.50)
	No	1253 (8.5)	14761	1
Illicit drugs	Yes	65 (12.1)	537	1.48 (1.14–1.94)

*n = 322 people in any paid employment did not respond to the work injury question.

Completed baseline questionnaires were obtained from 96% of participants. The current analysis is limited to the 15 687 NZBDHS participants who reported being “currently in any paid employment”.

Statistical analysis

The main occupation was coded according to the New Zealand Standard Classification of Occupations (NZSCO99), a hierarchical classification with nine major groupings (Appendix 2).¹⁶ Alcohol consumption was dichotomised to high and low risk, based on New Zealand government guidelines which define high risk drinking for men as >21 standard drinks per week or >6 drinks at any one session, and for women as >14 standard drinks per week or >4 drinks at any one session (standard drinks; see Appendix 1).

Stepwise logistic regression was performed to examine the potential predictive value of a range of demographic variables, occupational factors, lifestyle behaviours, and sleep disorders, with respect to the incidence of work injury. The model was built in a forward conditional stepwise fashion with probability to include set to 0.05. Goodness of fit was estimated using the Hosmer and Lemeshow test. Variables identified as significant in the stepwise analysis were used in the final model to derive estimates of the odds ratios for each factor, establishing how much more likely various subgroups were to having a work injury. Relative risk statistics are presented (with 95% confidence intervals) for each independent variable with respect to work injury. Statistical analysis

examined the relationship between work patterns and work injury, adjusted for significant lifestyle behaviours and sleep variables. All data were analysed using SPSS for Windows (version 11.5).

The study was approved by Auckland Area Health Board Ethics Committee, Auckland, New Zealand, and all participants provided informed consent.

RESULTS

Of the 15 365 (97.9%) NZBDHS participants in any paid employment providing a response, 1326 (8.6%) reported sustaining an injury at work that required treatment from a doctor during the past 12 months. A total of 3119 (21%) reported being employed on shift work (rotating shifts, with or without nights, or permanent night shifts) and 2331 (15%) reported working at least one night per week (table 1).

The recruitment method resulted in a sample of males and females in paid employment who were aged 16–84 with wide variations in the exposures of interest. Almost half were aged 40 years and over. Around a fifth were obese, reported a main occupation within heavy manual industries (NZSCO99 Classification 6–9, Appendix 2), would be considered a “risky” drinker or reported being a current smoker (table 1).

The prevalence of work injury in the past 12 months was most highly associated with occupational group and ranged from 5.4% among clerks to 19% among workers in heavy manual occupations.

Table 2 Unadjusted relative risk (RR) of work injury associated with sleep disorders, fatigue, headaches, and work injury among 15,687 paid employees*

		Work injury, n (%)	Total, n	RR (95% CI)
Sleep disorder	Nil	719 (7.5)	9582	1
	Snoring loudly	477 (10.1)	4706	1.39 (1.23–1.57)
	Apnoea/choke	121 (12.2)	989	1.72 (1.40–2.11)
Sleep sufficiency	Plenty	67 (8.2)	815	1
	Right amount	369 (7.0)	5249	0.84 (0.64–1.11)
	Want a bit more	654 (9.0)	7262	1.10 (0.85–1.44)
	Want a lot more	153 (10.1)	1512	1.26 (0.93–1.70)
	Not enough	74 (16.5)	449	2.20 (1.55–3.14)
	ESS <10	1105 (8.1)	13590	1
Daytime sleepiness	ESS ≥10	172 (12.9)	1334	1.67 (1.41–2.00)
	None	139 (7.2)	1936	1
Sleep difficulties (nights per month)	1–4	808 (8.0)	10144	1.12 (0.93–1.35)
	5+	338 (11.8)	2873	1.72 (1.40–2.12)
	None	242 (6.9)	3530	1
	1	176 (7.5)	2346	1.10 (0.90–1.35)
	2–4	415 (8.2)	5053	1.21 (1.03–1.43)
Fatigue (times per month)	5–15	349 (10.9)	3207	1.66 (1.40–1.97)
	16–20	119 (12.1)	981	1.88 (1.49–2.37)
	No	972 (8.2)	11862	1
	Yes	304 (10.3)	2962	1.28 (1.12–1.47)

*n = 322 people in any paid employment did not respond to the work injury question.
ESS, Epworth Sleepiness Score.

Univariate associations with work injury

Reporting work injury in the past 12 months was most highly associated with occupation and work hours: heavy manual industries (NZSCO99 Classification 6–9) (relative risk, 95% CI: 3.6, 2.8 to 4.6), service/sales (NZSCO99 Classification 5) (2.0, 1.6 to 2.6), working rotating shifts with nights (2.1, 1.7 to 2.5), working three or more nights a week (1.9, 1.6 to 2.3), or working more than 40 hours a week (1.6, 1.4 to 1.8). Work injury was also significantly associated with individual and lifestyle factors such as male gender (1.9, 1.7 to 2.2) and being overweight or obese (1.7, 1.5 to 2.0) as well as being considered a high risk drinker, being a current smoker, or using marijuana or other illicit drugs in the past 12 months (table 1).

Almost one third of these workers in paid employment reported being (ever) told that they snored loudly (table 2). Most workers (60%) reported being dissatisfied with the quantity of sleep they were getting, 20% experienced headaches in the past year that stopped or decreased daily activities, and almost 10% experienced excessive daytime sleepiness (ESS >10) (table 2). Only 412 (2.8%) reported using sleep medications more than once a month. Each of these sleep related variables was independently significantly associated with work injury (table 2).

Rotating shift work, permanent night work, and irregular/other working patterns were all significantly associated with a main occupation in service/sales or within heavy manual industries. However, these working patterns were all associated with a decreased risk of working more than 40 hours

per week. Working rotating shifts with nights was the only working pattern significantly associated with reporting excessive daytime sleepiness (ESS >10) (table 3).

Mutually adjusted associations with work injury

All variables (tables 1 and 2) were introduced into a stepwise logistic regression analysis. Ten variables were identified as significant and Hosmer and Lemeshow goodness of fit test indicated the model adequately fitted the data ($p = 0.37$). Working rotating shifts with nights (1.9, 1.5 to 2.4) or working rotating shifts without nights (1.8, 1.2 to 2.6) remained highly associated with work injury, even after adjusting for sex, education, hours worked, smoking, daytime sleepiness, sleep difficulties, headaches, BMI, and occupation (table 4). Working permanent nights was no longer significantly associated with work injury when accounting for these other risk factors. Working more than 40 hours per week was, similarly, a risk factor for work injury (1.3, 1.1 to 1.5) after adjusting for work pattern and the other variables with significant unadjusted associations with work injury.

DISCUSSION

The results of this large study show that the increased incidence of work injury among rotating shift workers occurs independently of individual, lifestyle, or occupational factors. Rotating shift workers whose rotation included night work still retained an almost twofold increased risk of work injury in the previous 12 months compared with daytime (non-

Table 3 Unadjusted relative risk (95% CI) of various lifestyle and work related factors and sleep disorders according to work pattern

	Irregular/other (n = 2948)	Rotating, no nights (n = 327)	Permanent nights (n = 638)	Rotating, with nights (n = 978)
Occupation (NZSCO99 5–9)*	2.79 (2.51–3.10)	2.94 (2.30–3.75)	6.40 (5.20–7.99)	4.48 (3.85–5.21)
Working >40 hours per week	0.40 (0.36–0.44)	0.62 (0.49–0.79)	0.11 (0.08–0.16)	0.78 (0.68–0.89)
Snoring	0.68 (0.62–0.74)	0.83 (0.66–1.05)	0.43 (0.36–0.52)	0.93 (0.81–1.06)
Daytime sleepiness (ESS >10)	1.06 (0.92–1.23)	1.11 (0.76–1.63)	1.00 (0.75–1.33)	1.46 (1.19–1.80)
Current smoking	1.22 (1.10–1.37)	1.31 (0.98–1.75)	1.97 (1.63–2.38)	1.55 (1.32–1.83)
Obesity (BMI 30+)	0.84 (0.75–0.94)	0.85 (0.63–1.16)	0.77 (0.61–0.97)	0.96 (0.80–1.14)

*Service/sales or heavy manual (Appendix 2).
Each odds ratio compares presence to absence of the risk factor.
ESS, Epworth Sleepiness Score.

Table 4 Mutually adjusted relative risk (RR) of work injury among 15 365 paid employees

		RR (95% CI)
Sex	Male v female	1.29 (1.09–1.53)
Education	Primary/high/secondary	1
	Polytechnic or similar	1.07 (0.90–1.27)
	University	0.78 (0.63–0.97)
	Daytime, no shifts	1
Usual work pattern	Irregular/other	1.17 (0.95–1.43)
	Rotating, no nights	1.75 (1.17–2.61)
	Permanent nights	1.38 (0.95–2.00)
	Rotating, with nights	1.89 (1.49–2.41)
Hours worked	More than 40 h v 40 h or less	1.32 (1.12–1.55)
Smoking	Current smoker v not	1.46 (1.21–1.75)
Daytime sleepiness	ESS >10 v ≤10	1.34 (1.07–1.67)
Sleep difficulties	None	1
	1–4 monthly	1.26 (0.99–1.60)
	5 or more monthly	1.67 (1.28–2.18)
Headaches decrease activities	Yes v no	1.60 (1.34–1.90)
BMI	15–24	1
	25–29	1.28 (1.07–1.52)
	30+	1.49 (1.22–1.82)
	Legislator/administrator/manager	1
Occupation (Appendix 2)	Professional	1.29 (0.93–1.80)
	Associate professional/technician	1.29 (0.93–1.80)
	Clerk	1.22 (0.85–1.75)
	Service/sales	2.28 (1.63–3.18)
	Agriculture/trades/machine/elementary	4.04 (2.98–5.47)

ESS, Epworth Sleepiness Score.

shift) workers. Similarly, shift workers whose rotation did not include nights still retained a 75% increased risk of work injury in the previous 12 months. This study also clearly shows that work injury remains highly associated with both occupation and exposure time (working more than 40 hours a week), even when accounting for other high risk individual factors and work patterns.¹⁷ A highly significant two- to fourfold increased association with work injury remained for workers employed in service/sales or heavy manual industries (NZSCO99 Classifications 5–9) (table 4).

There is convincing evidence from other studies that within a rotating shift system, the night shift carries the highest risk of work injury, compared with the morning or afternoon shifts.^{11–18} However, the current study showed that employment on a permanent night shift was not associated with increased risk of work injury, after controlling for other high risk individual, lifestyle, or occupational factors. Interestingly, permanent night shift was not associated with an increased risk of reporting excessive daytime sleepiness (table 3), supporting previous evidence of the reduced effect of permanent night shifts, compared with rotating shifts, on accumulating sleep debt.^{19–20} However, another factor possibly influencing the lack of association between permanent night shift and work injury is that more than 50% of workers required to work nights reported usually working less than three nights per week (table 1). It would appear from the results of this study that if a night shift is unavoidable, then scheduling permanent night staff, instead of incorporating the night shift in a rotating roster, will result in reduced rate of work injury.

Previous studies have clearly linked obesity and smoking to snoring and sleep apnoea.²¹ Both snoring and sleep apnoea were associated with work injury (table 2). However, the risk of snoring and sleep apnoea was not significantly increased among night shift workers (rotating or permanent) (table 3). This finding may be related to the non-significant or reduced risk of obesity among these workers or to marital status and the self-report nature of the sleep disordered breathing assessment. Only 18% of permanent night shift workers and 45% of workers on rotating shifts with nights were “married or living with a partner”, compared with 67% of workers on

regular daytime work. It is possible that the self-reported nature of the assessment of sleep disordered breathing has led to under-reporting among workers not “married or living with a partner”. The self-report rates in the NZBDHS are lower than when sleep apnoea is measured objectively (9% women and 24% of men);²² however, this finding may simply be related to a “healthy shift worker” effect, with only workers able to cope with this disruption to the circadian rhythm remaining in such employment. Therefore, educational campaigns targeting smoking or obesity among shift workers, while beneficial for overall health, may not necessarily reduce the burden of work injury.

The 8.6% prevalence of work injury in the NZBDHS is unlikely to be representative of the prevalence in the general population. Apart from difficulties associated with an accurate event recall of the past 12 months, fatalities or people who had experienced severe work injuries restricting mobility will have been missed. However, the distribution of work injury prevalence according to occupation in this study is comparable to estimates in the general New Zealand population,² that is, 5–7% for NZSCO99 Classifications 1–4 and 12–19% for NZSCO99 Classifications 5–9 in the NZBDHS, compared with 3–8% and 10–17%, respectively, in the New Zealand population. It is likely that the overall prevalence of work injury in the NZBDHS is lower than the New Zealand prevalence as the high risk occupational groups were under-represented in the NZBDHS. According to the 2001 New Zealand census, approximately a third of all workers in New Zealand are employed in these high risk occupations (NZSCO99, Classifications 5–9). However, only 19% of the NZBDHS participants were engaged in these occupations. It is also possible that those who had suffered an injury may have subsequently opted for daytime work routines, attenuating the association between shift work and work injury. In addition, if the NZBDHS recruitment has resulted in a sample of “healthy shift workers”, compared with non-shift workers, the prevalence of sleep disorders and complaints or risky lifestyle behaviours (smoking, alcohol, illicit drugs) may be under-estimated, possibly distorting the association between shift work and work injury. The analysis was cross-sectional, limiting accurate estimation of the magnitude of such

Main messages

- Rotating shift work is associated with increased risk of work injury, even when accounting for occupation, number of working hours, lifestyle behaviours, and sleep disorders.
- Permanent night work is not associated with increased risk of work injury after adjusting for these other risk factors.
- Work injury is mostly strongly associated with occupational group.

Policy implications

- When a 24 hour production schedule is unavoidable, then a permanent night roster, rather than incorporating the night time hours within a rotating shift system, is likely to reduce the incidence of work injury.

“survivor” self-selection or drawing firm conclusions of causal relationships.²³

The NZBDHS has several strengths. It included a large sample of men and women in paid employment with a wide distribution of exposures to work injury risk factors. The response rate to the survey was excellent and detailed information was collected on occupation and usual working patterns with specification required for shift work (rotating shift with nights, rotating shifts without nights, permanent nights). The self-administered questionnaire included a range of measures of sleep disorders, sleep complaints, and daytime sleepiness as well as information on smoking, alcohol, and illicit drug use. In addition, height and weight were measured by study staff, rather than self-reported. Work injury was clearly defined as an injury severe enough to required treatment from a doctor. This large group of workers from a range of occupational groups and working patterns is well able to provide generalisable estimates of associations between the collected risk factors and work injury.

Conclusion

In the NZBDHS, even after accounting for decreased working hours relative to non-shift workers, rotating shift work was associated with a markedly increased risk of work injury which was not explained by the higher prevalence of other significant individual, lifestyle, or occupational risk factors such as employment in heavy manual industries, smoking, and excessive daytime sleepiness among these workers. Permanent night work was not associated with increased risk of work injury when accounting for these other factors.

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Funding: this study was funded by the Health Research Council of New Zealand

Competing interests: none declared

APPENDIX 1

WORK

Work injury

During the past 12 months have you required treatment from a doctor for an injury at work? *Yes/No*

Work pattern

What is your usual work pattern?

- *Daytime with no shifts*
- *Rotating shifts with nights*
- *Rotating shifts without nights*
- *Permanent nights*
- *Irregular or variable*
- *Other work pattern*

LIFESTYLE FACTORS

Smoking

Do you smoke cigarettes (not cigars/pipe) now? *Yes/No*

Alcohol

Do you currently drink alcohol once a month or more? *Yes/No*

If yes, how often do you drink alcohol? *6–7 days a week/4–5 days a week/2–3 days a week/once a week/once every 2 weeks/once a month*

On an average day when you drink alcohol, how many drinks would you usually have in total?

- Beer
 - 1 can = 1 drink
 - 1 small bottle = 1 drink
 - 1 handle = 1 drink
 - 1 quart = 2 drinks
 - 1 jug = 3 drinks
 - 1 flagon = 6 drinks
- Wine, sherry (or similar)
 - 1 glass = 1 drink
 - 1 bottle = 6 drinks
- Spirits
 - 1 double nip = 1 drink

Marijuana

During the past 12 months how often did you use marijuana (also know as grass, pot, cannabis, hashish, hash oil)? *Did not use/less than once a month/once a month/once every 2 weeks/once a week or more often*

Other illegal drugs

During the past 12 months how often did you use other illegal drugs? (that is, drugs not prescribed by your doctor or bought from a chemist, such as cocaine, LSD, amphetamines or speed, heroin, morphine). *Did not use/less than once a month/once a month/once every 2 weeks/once a week or more often*

Fatigue

How often (number of times per month) do you feel unrested during the day, no matter how many hours of sleep you had. *0, 1, 2–4, 5–15, 16–30 times per month*

Headaches

During the past year have you experienced headaches that:

- Usually lasted for more than 4 hours and less than 3 days?
Yes/No
- Stopped or decreased your daily activities? *Yes/No*

SLEEP

Sleep disorders (Yes/No)

- Have you ever been told that you snore loudly?
- Have you ever been told that you stop breathing while you sleep?
- Have you even been told that you appear to choke while you sleep?

Sleep complaints

Sleep sufficiency

How do you feel about the amount of sleep you normally get?
Nowhere near enough/Could do with a lot more/Could do with a bit more/Get the right amount/Get plenty

Difficulties

Please indicate how often (number of times per month) you experience each of the following: (0, 1, 2–4, 5–15, 16–30 times per month)

- Have trouble falling asleep
- Wake up during the night and have difficulty getting back to sleep
- Wake up too early in the morning and be unable to get back to sleep

Each question is scored 0 to 4, resulting in a total score range 0–12. Results were classified into three groups: 0, 1–6, 7–12.

Daytime sleepiness (Epworth Daytime Sleepiness Scale)¹⁵

How likely are you to doze off or fall asleep (not just “feel tired”) in each of the following situations? (*never, slight, moderate, high*)

- Sitting and reading
- Watching TV
- Sitting inactive in a public place (e.g. a theatre or a meeting)
- Riding as a passenger in a car for an hour without a break
- Lying down to rest in the afternoon when circumstances permit
- Sitting and talking to someone
- Sitting quietly after lunch without alcohol
- In a car, while stopped for a few minutes in traffic

Each question is scored 0 to 3, resulting in a score range 0–24. Scores >10 are taken to imply excessive daytime sleepiness.

Sleep medication

How often (number of nights per month) do you take sleeping pills or other medications to help you sleep? 0, 1, 2–4, 5–15, 16–30 nights per month

APPENDIX 2

NEW ZEALAND STANDARD CLASSIFICATION OF OCCUPATIONS (NZSCO99)¹⁶

1. Legislators, administrators, and managers
 - Legislators and administrators
 - Corporate managers

2. Professionals
 - Physical, mathematical, and engineering science professionals
 - Life science and health professionals
 - Teaching professionals
 - Other professionals
3. Associate professionals and technicians
 - Physical science and engineering associate professionals
 - Life science and health associate professionals
 - Other associate professionals
4. Clerks
 - Office clerks
 - Customer services clerks
5. Service and sales workers
 - Personal and protective services workers
 - Salespersons, demonstrators and models
6. Agriculture and fishery workers
 - Market oriented agricultural and fishery workers
7. Trades workers
 - Building trades workers
 - Metal and machinery trades workers
 - Precision trades workers
 - Other craft and related trades workers
8. Plant and machine operators and assemblers
 - Industrial plant operators
 - Stationary machine operators and assemblers
 - Drivers and mobile machinery operators
 - Building and related workers
9. Elementary occupations
 - Labourers and related elementary service workers

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